SCIENCE, TECHNOLOGY, AND SOCIETY

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Technology and science are activities of central importance in modern life, intimately bound up with industrial society's evolving character, problems, and potentials. If scientific and technological pursuits are to further enhance human well-being, they and their effects on society and the individual must be better understood by nontechnical professionals and ordinary citizens as well as by engineers and scientists. Issues of professional ethics and social responsibility confront technical practitioners. At the same time, lawyers, public officials, civil servants, and business people are increasingly called upon to make decisions requiring a basic understanding of science and technology and their ethical, social, and environmental consequences. Ordinary citizens, moreover, are being asked with increasing frequency to pass judgment on controversial matters of public policy related to science and technology. These circumstances require education befitting the complex sociotechnical character of the contemporary era.

Science, Technology, and Society (STS) is an interdisciplinary program devoted to understanding the natures, consequences, and shaping of technological and scientific activities in modern industrial society. Achieving this understanding requires critical analysis of the interplay of science and technology with human values and world views, political and economic forces, and cultural and environmental factors. Hence, students in STS courses study science and technology in society from a variety of perspectives in the humanities and social sciences. To provide a basic understanding of technology and science, STS majors are also required to achieve either literacy (A.B.) or a solid grasp of fundamentals (B.S.) in some area of engineering or science.

GENERAL INFORMATION

Selected STS courses may be used, individually or in groups, for various purposes:

1. To satisfy University General Education Requirements
2. To satisfy the Technology in Society Requirement of the School of Engineering
3. To comprise parts of student-designed concentrations required for majors in fields such as Human Biology and Public Policy
4. To satisfy the requirements of the STS Honors Program complementing any major (see below)
5. To satisfy requirements for majors in STS (see below)
6. To satisfy requirements for a minor in STS (see below)

STS courses are particularly valuable for undergraduates planning further study in graduate professional schools (for example, in business, education, engineering, law, journalism, or medicine) and for students wishing to relate the specialized knowledge of their major fields to broad technology- and science-related aspects of modern society and culture.

UNDERGRADUATE PROGRAMS

Degree programs in STS are interdisciplinary curricula devoted to understanding the nature and significance of technology and science in modern society. Majors analyze phenomena of science and technology in society from ethical, aesthetic, historical, economic, and sociological perspectives. In addition, students pursuing the A.B. degree study a technical field in sufficient depth to obtain a grasp of basic concepts and methods, and complete a structured concentration on a theme, subarea, or problem related to science and technology in society. Those seeking the B.S. degree complete at least 50 units in technology, science, and mathematics. The particular technical courses chosen reflect the student's special interest in science and technology in society. Specific requirements for the bachelor's degree in STS are as follows:

BACHELOR OF ARTS

1. STS Core (eight courses):
   a) Interdisciplinary Foundational course (STS 101 or 101Q)
   b) Disciplinary Analyses (five courses with no more than two courses in each category):
      1) Philosophical perspectives (STS 110, 113, 117, 118, 119, 133)
      2) Historical perspectives (STS 102, available as core course 2001-02; 121; 123, available as core course 2001-02; 124; 125)
      3) Social Science perspectives (STS 107, 137, 138, 149, 155, 162)
   c) Advanced courses (one course in each category):
      1) Disciplinary analysis (STS 207, 215, 219, 229, 231, 255 or 266)
      2) Senior Colloquium (STS 200)
2. Technical Literacy (five courses):
   a) Computer literacy, normally demonstrated by successfully completing Computer Science 105 or its equivalent.
   b) Science or engineering literacy demonstrated by *one* of the following:
      1) Completing a four-course sequence (minimum of 12 units) in one field of engineering or science (sample sequences available in the STS office).
      2) Completing four of the following "Engineering Fundamentals" courses: Engineering 14, 15, 20, 30, 40, 50, 60, 70 (see the descriptions in the "School of Engineering" section of this bulletin.
3. Thematic Concentration (minimum of 20 units, at least five courses, one each from among those designated on the appropriate concentration course list as "foundational" and "advanced"). Thematic Concentrations are organized around an STS-related problem or area. The following Thematic Concentration topics have been preapproved: the intersections of technology and science with aesthetics, development, history and philosophy, information and society, public policy, social change, and work and organizations.

Course lists for these concentration topics are available in the STS office. A student selecting one of the certified topics may include one or more courses not on the corresponding course list if they are germane to the concentration and meet the student's special interests. Alternatively, the student may choose to design a Thematic Concentration topic and course package subject to program approval. Each Thematic Concentration, certified or self-designed, requires the signature of an appropriate faculty adviser. See the program chair for details.

BACHELOR OF SCIENCE

The student pursuing the B.S. degree shall complete the STS Core and a structured package of at least 50 units of technical courses intended to enable students to understand socially significant technical phenomena in some field of engineering or science. Introductory courses in mathe-

matics or physics (for example, Mathematics 19 or Physics 19) are normally not counted as parts of this technical depth component.

The B.S. candidate follows one of two models in fulfilling the minimum 50-unit requirement:

1. "Focused Depth": at least 24 units and seven courses in a single field of science or engineering, with the remaining units (except for at most two stand-alone courses) grouped in clusters of at least three courses each in other fields of science or engineering. For example, a Focused Depth package might contain eight mechanical engineering, three physics, three mathematics, and three computer science courses, and one course each in electrical engineering and chemistry.
2. "Clustered Depth": two or more clusters of at least five courses and 15 units each in different fields of science or engineering, with at most two stand-alone courses, and remaining courses, if any, in sequences of three or more courses. For example, a Clustered Depth package might contain five-course clusters in computer science, electrical engineering, and physics, and three courses in civil engineering and one course each in biology and chemical engineering.

It is strongly recommended that B.S. majors complete Computer Science 106A or its equivalent.

MINORS

Students planning careers in many technical and non-technical fields, including business, education, engineering, science, law, medicine, and public affairs, are faced with important STS issues in their professional practice. Therefore, a minor in STS is likely to prove practically valuable as well as intellectually stimulating.

Requirements—The STS minor requires successful completion of six courses satisfying the following four requirements:

1. Foundational Course (STS 101 or 101Q)
2. One disciplinary analysis course from each of the following three categories
   a) Philosophical/Ethical Perspectives (STS 110, 113, 115, 117, 118, 119)
   b) Historical Perspectives (STS 102, available as core course 2001-02; 121; 123, available as core course 2001-02; 124; 125 or 132)
   c) Social Scientific/Policy (STS 107, 137, 138, 149, 155, 162, 170, 171 or 183)
3. Two advanced courses, from one or two of the following categories, building on courses taken under requirements 1 and 2:
   a) Philosophical/Ethical Perspectives (STS 215)
   b) Historical Perspectives (STS 229)
   c) Social Scientific/Policy Perspectives (STS 207, 219, 231, 233, 255, 266, 279, 280)
4. At least one of the courses taken under requirements 1 to 3 must incorporate a weekly small group discussion.

Note—Students wishing to use a course not listed above to satisfy one of the requirements for a minor in STS may petition to do so. For details, inquire at the STS office (Bldg. 370, room 109).

HONORS PROGRAM

STS offers a limited number of students an opportunity to achieve honors through in-depth study of the interaction of science and technology with society. The honors program is open to students majoring in any field (including STS). Students accepted for this program carry out an honors project, the work for which normally begins in Spring Quarter of the junior year and is completed by mid-May of the senior year. Usually, this project entails writing an honors essay, although occasionally students have chosen to produce a technical artifact or carry out some other work that itself represents original thinking. When a project results in a work other than an essay, students must also submit an accompanying scholarly exegesis of the work.

ADMISSION

Application for admission to the STS honors program is typically made during the last quarter of the student's junior year. By the eighth week of that quarter, interested students must have completed, or be completing that quarter, at least two of the four courses required to satisfy honors requirements 1 to 4 listed below. Each applicant must also have submitted a formal proposal for her or his project to the STS Honors Committee. For proposal parameters, see the brochure *Honors Program Requirements*, available in the STS office. Students whose proposals are approved are encouraged to apply to attend Honors College in early September to get a running start on their theses. STS honors students are also encouraged to sign up for 3-5 units of credit per quarter in STS 190A,B,C for work on the honors project. While not required, doing so will leave the student sufficient time to finish the thesis in three quarters. Writing a senior honors thesis while simultaneously carrying a full academic load each quarter is a very difficult task to complete with distinction. STS majors pursuing honors in STS or another honors program take STS 200 for 2 units instead of 4 and do not write a research paper for this required course. However, failure to complete the thesis requires additional research work in STS 200. (Note: under exceptional circumstances, a student may be admitted to the STS honors program early in the first quarter of his or her senior year.)

REQUIREMENTS

1. Foundational Course: STS 101 or 101Q.
2. One Philosophical and Ethical Perspectives Course: STS 110, 113 or 118.
3. One Historical Perspectives Course: STS 102 (available as core course 2001-02), 107, 121, 123 (available as core course 2001-02), 124 or 125.
4. One Social Science Perspectives Course: STS 107, 137, 138, 149, 155, 162, 170, 171 or 183.
5. Honors Project: an original critical essay (or investigative project with accompanying explanatory essay) on an STS topic of general importance (12 to 15 units). Past honors projects are on file in the STS library.

To earn honors, the project must receive a grade of at least 'B.' The student not majoring in STS must also achieve a grade point average (GPA) of at least 3.3 in the courses taken to satisfy requirements 1 to 4 above. In the case of STS majors, the student must compile a GPA of at least 3.3 in the entire STS core. If all these requirements are met, the designation "Honors Program in Science, Technology, and Society" is affixed to the student's permanent record and appears in the commencement program.

COURSES

(WIM) indicates that the course meets the Writing in the Major requirements.

The STS Web site (http://www.stanford.edu/group/STS/) contains updated course scheduling information, course syllabi, faculty and staff information, and forms for declaring a major or a minor in STS.

101. Science, Technology, and Contemporary Society—(Graduate students register for 201; same as Engineering 130.) Analysis of the interplay of science, technology, and society in the contemporary U.S. Topics: the key social, cultural, and values issues raised by contemporary scientific and technological developments; distinctive features of science and engineering as socio-technical activities; major influences of scientific and technological developments on 20th-century society, including transformations and problems of work, leisure, human values, the fine arts, and international relations; ethical conflicts in scientific and engineering practice; and the social shaping and management of contemporary science and technology. GER:3b (DR:9)

4-5 units, Aut (McGinn)

101Q. Stanford Introductory Seminar: Technology in Contemporary Society—Preference to sophomores. Introduction to the STS field. Topics: the natures of science and technology and their relationship, what is most distinctive about these forces in our day, and how they have transformed and been affected by contemporary society. Salient social,

cultural, and ethical issues raised by recent scientific and technological developments. Case studies from specific areas, e.g., information technology and biotechnology, with emphasis on the contemporary U.S. Unexpected influences of science and technology on contemporary society and how social forces shape the scientific and technological enterprises and their products. Focus is on developing the ability to think critically, comprehensively, and in a balanced way about technology in contemporary society. Enrollment limited to 12.

4 units, Aut (McGinn)

102. Science, Technology, and Art: The Worlds of Leonardo—A historical introduction to the intersections among science, technology, and society, and an interdisciplinary introduction to Renaissance studies. The 15th-century artist, engineer, and inventor continues to inspire our own ideas about innovative, interdisciplinary work. Why does this Renaissance figure continue to fascinate us? The world of the historical Leonardo, looking at his range of interests and accomplishments (e.g., Mona Lisa, human anatomies, flying machines) and the culture of invention that shaped him. Students think with Leonardo, reconstructing some of his projects. The persistence of the Renaissance as a touchstone for innovation in the 21st century, examining the "myth of Leonardo."

3-5 units, Aut (Gorman)

107. Technology and Economic Change—(Enroll in Economics 113.)

5 units, not given 2000-01

110. Ethics and Public Policy—(Same as Public Policy 103B.) Ethical issues in science- and technology-related public policy conflicts. Develops the capacity for rigorous critical analysis of complex, value-laden policy disputes. Topics: the natures of ethics and morality; the natures of and rationales for liberty, justice, and human rights; and the use and abuse of these concepts in recent and current policy disputes. Cases from: biomedicine, environmental affairs, the technical professions, communications, and international relations. Given demand, one seminar section may be offered in French. GER:3a (DR:8) (WIM)

5 units, Win (McGinn)

113. Technocritique—(Enroll in French 128.)

3-5 units, Spr (Dupuy)

115. Ethical Issues in Engineering—(Same as Engineering 131.) Ethical issues in contemporary engineering practice. Topics: the moral rights and responsibilities of engineers in relation to society, employers, colleagues, and clients; cost-benefit-risk analysis, safety, and informed consent; the ethics of whistle blowing; ethical conflicts of engineers as expert witnesses, consultants, and managers; ethical issues in engineering design, manufacturing, and operations; ethical issues arising from engineering work in foreign countries; and ethical implications of the social and environmental contexts of contemporary engineering. Use of real-life case studies, guest practitioners, and field research. Limited enrollment. GER:3a (DR:8)

4 units, Spr (McGinn)

116Q. Stanford Introductory Seminar: Reality Redefined—The Transition from the First Millenium to the Renaissance—(Enroll in Italian 194Q.)

3-4 units, Win (Fusco, Napolitano)

117. Art and Technology—(Enroll in Art and Art History 172.)

4 units (Lee) not given 2000-01

118. The Invention of Modern Architecture—(Enroll in Art and Art History 141.)

4 units, Aut (Turner)

119. Cyborgs and Synthetic Humans—(Enroll in Art and Art History 162.)

4 units (Bukatman) not given 2000-01

121. Technology and Culture in 19th-Century America—(Enroll in History 115.)

4-5 units, Spr (Corn)

122. Before Babel: Knowledge and Communication in Early Modern Europe—How do people learn to communicate? How do knowledge and technology shape communication? Information exchange when the printing press was a new and powerful tool for disseminating ideas, and technology itself changed how people thought of knowledge. The material and social conditions of information exchange in the 17th century, looking at books, instruments, collections, patronage, systems of writing, reading, and translating, and the social identities these systems created. Early discussions of information technology and attempts to improve it, e.g., the invention of new, universal languages, and the utopian visions of communication driving such projects.

5 units, Spr (Wilding)

123. The Scientific Revolution—What sort of tools do historians use to understand and interpret science? How did science emerge as a distinctive kind of knowledge? The history of science as a field of study, using the Scientific Revolution of the 16th and 17th centuries; the age of Copernicus, Galileo, Kepler, and Newton as a case study in the historical interpretation of science. The intellectual, cultural, and institutional context in which western science emerged. How historians have explained and debated the birth pangs of modern science.

5 units, Win (Gorman)

124. American Economic History—(Enroll in Economics 116.)

5 units, Win (Wright)

125. The Emergence of Modern Medicine—(Enroll in History 13.)

5 units, Spr (Findlen)

126. The Prehistory of the Computer—Why trust a machine? The 17th and 18th centuries saw a proliferation of attempts to mechanize human thoughts and actions. The dream of encapsulating tedious calculations in a "black-box" occupied Kepler, Pascal, and a host of scholars in the early modern period, leading to Charles Babbage's development of the analytical and difference engines in the 1830s. The evolution of such machines, their place in society, their theoretical basis, and the practical limits of their use, emphasizing the changing relationship between the automation of calculation and the simulation of human behavior through automata.

3-5 units, Spr (Gorman)

127. Undergraduate Colloquium: Science in the Islamic World—(Enroll in History 290.)

5 units, Aut (Dallal)

131. Bodies and Machines: From Descartes to Frankenstein—What is the history of the relationship between the body and technology? How does the body become dissected, mechanized, and industrialized? How is it made whole with prosthetics or surpassed with instruments? The attempts to represent, replicate, and supplement the body and the mind. What are the idealized fantasies of the body and the mind at different moments in culture? Scientific and artistic images and seminal texts from Descartes to Frankenstein, and instruments (microscopes, memory theaters, and calculating machines).

3-5 units, Aut (Wilding)

132. Undergraduate Colloquium: Yesterday's Tomorrows—Technology and the "Future" in History—(Enroll in History 267.)

5 units (Corn) not given 2000-01

133. Invention of Science—(Enroll in Classics 133.)

3-4 units, Aut (Netz)

135. Stanford Introductory Seminar: Technologies of Civilization, Writing, Number, Money—(Enroll in Classics 22N.)

3-4 units, Aut (Netz)

137. U.S. Communication Policy—(Enroll in Communication 137.)
5 units, Win (Bar)

138. International Security in a Changing World—(Enroll in Political Science 138.)
5 units, Aut (Blacker, May, Perry, Sagan)

140. Information Revolutions: Technology and Forms of Knowledge—The relationship between the development of information technologies and intellectual/cultural history from antiquity to the present. Topics: the shift from orality to literacy (and the invention of early alphabets and writing) in early civilization; the influence of printing technologies in the Renaissance, Reformation, and Scientific Revolution; the culture of print in the modern world; technologies of information management and control; computers, the Internet, and the contemporary "age of information."
3 units, Aut (Pang)

145. History of Computer Game Design: Technology, Culture, and Business—Reading, discussion, reports, and projects on the developing culture and technology of computer and video game design. Historical contexts include entertainment media, computing technology, applications of gaming technology, and business history. Topics: play in human culture, early computer games from chess to Spacewar, the role of artificial intelligence research, the history of computer graphics and sound technology, the evolution of techniques and genres of computer game design, video game machines, games and the microcomputer revolution, networked gaming, gadgets and games as factors in the evolution of software and hardware, marketing, gendering of games and game play, virtual worlds, simulation, video and computer game industries, technology transfer (e.g., military simulations).
4 units, Win (Lowood)

149. Trials of the 20th Century: Technology, Law, and Culture—(Enroll in Cultural and Social Anthropology 85.)
5 units, Aut (Jain)

155. Science, Technology, and Gender—(Enroll in Cultural and Social Anthropology 132.)
5 units, Win (Jain)

162. Computers and Interfaces: Psychological and Social Issues—(Enroll in Communication 169.)
5 units, Win (Nass)

164. The Internet and Social Values—The rapid growth of the Internet has fractured social networks long used by cultures, communities, and individuals for connection and interaction. There are three phases of this phenomenon: infrastructure enablement, productivity enhancement, and cultural changes in communication and learning. Topics: history and design architecture of the Internet; the culture of Silicon Valley venture capital in promulgating technology improvements; economic evolution of telecommunications; individual empowerment; changing computer applications and social values; role of Internet anonymity; dynamic growth of the Internet; conflict between "openness" and "proprietariness" in the Internet world. Real world case studies illustrate themes. Prerequisite: basic familiarity with Internet browsing.
3 units, Spr (Siminoff)

170. Work, Technology, and Society—(Enroll in Management Science and Engineering 182.)
4 units (McGinn) given 2001-02

171. Technology in National Security—(Enroll in Management Science and Engineering 193/293.)
3 units, Aut (Perry)

183. Media Economics—(Enroll in Communication 183.)
5 units, Spr (Bar)

190A,B,C. Honors Project—Project for students in STS honors program.

190A. Submission of Proposal
2-5 units, Aut, Win, Spr (Staff)

190B. Continued Study and Writing
2-5 units, Aut, Win, Spr (Staff)

190C. Final Work on Project
2-5 units, Aut, Win, Spr (Staff)

195. Honors Tutorial
1 unit, Aut, Win (Staff)

199. Individual Work
1-5 units, Aut, Win, Spr (Staff)

200. Senior Colloquium—Reading/discussion of key analytical and theoretical texts treating the natures and interplay of science, technology, and society. Only STS majors writing senior honors theses may take for 2 units. Prerequisite: STS major with senior standing and four STS core courses, or consent of the instructor.
2 or 4 units, Win (Pang)

ADVANCED UNDERGRADUATE AND GRADUATE

201. Science, Technology, and Contemporary Society—(Same as Engineering 130.) See 101.
4-5 units, Aut (McGinn)

207. Science and Technology in Economic Growth—(Enroll in Economics 224.)
5 units, not given 2000-01

215. Computers, Ethics, and Social Responsibility—(Enroll in Computer Science 201.)
4 units, Win (Roberts)

219. Management and Organization of Research and Development—(Enroll in Management Science and Engineering 281.)
4 units (Barley) not given 2000-01

226. Women and Medicine in the United States—Exploration of ideas about women's bodies in sickness and health, and women's encounters with lay and professional healers in the U.S. from the 18th century to the present. Topics: ideas about women's life cycle and sexuality; the social construction of women's bodies and physical limitations; the history of birth control; abortion and childbirth; menopause and aging; women as healers, including midwives, lay physicians, and female doctors and nurses. Developments in medical science and technology as they have affected and continue to affect women. Comparison of historical and contemporary experiences of women in relation to medicine, including efforts of women to gain control of their health care.
5 units, Win (Horn)

229. Undergraduate Colloquium: When Worlds Collide—The Trial of Galileo—(Enroll in History 216.)
5 units, Win (Findlen)

231. Technology and Work—(Enroll in Management Science and Engineering 284.)
4 units (Barley) not given 2001-02

233. Culture and Technology—(Enroll in Education 306C.)
4 units, Spr (McDermott)

255. Anthropology of Disasters—(Enroll in Cultural and Social Anthropology 283.)
5 units, Spr (Jain)

260. Information Technology in Society: Legal and Policy Perspectives—Analysis of issues at the interface of law, computer science, and information technology. Topics: intellectual property controversies (e.g., DVD, copyright, and Napster), technological and policy issues around the Internet (e.g., monitoring, access filters, encryption, domain names, and the Digital Divide), and commerce issues (e.g., network security, taxation, and U.S. and European approaches to privacy). The technical, legal, political, and ethical components of the controversies studied. Seminar format, with enrollment limited to 20 advanced undergraduates. Prerequisite: a course in computer science or consent of instructor.
4 units, Spr (Simons)

266. Communication Policy in Comparative Perspectives—(Enroll in Communication 166/266.)
4-5 units (Bar) not given 2000-01

279. Technology, Policy, and Management in Newly-Industrializing Countries—(Same as Management Science and Engineering 298.) Technology is seen as the key to development and prosperity in most parts of the world. Building technological capability in newly-industrializing countries at the national and firm level. What makes technology special, government intervention that affects technology, the concept of technology leader and technology follower environments, the transfer of technology from "leader" countries, indigenous technological capability, human capital, culture and innovation, the role of small firms and new enterprises in technological capability. Managing innovation in firms: how innovation is different in technology-followers, organizing for shop-floor innovation, building an innovation culture, the special role of R&D in followers, the role of design, technology strategy for followers. Cases from Korea, India, Brazil, Singapore, and other NICs.
2-4 units (Forbes) not given 2000-01

280A,B. Research Workshop: Commercialization of Knowledge—(Enroll in Education 374A,B.)
2-3 units, Aut, Win (Powell)

299. Advanced Individual Work
1-5 units, Aut, Win, Spr (Staff)

RELATED DEPARTMENT OFFERINGS

AMERICAN STUDIES

152. American Spaces: An Introduction to Material Culture and the Built Environment
5 units, Spr (Corn)

ENGINEERING

1N. Stanford Introductory Seminar: The Nature of Engineering
3 units, Aut (Freyberg)

HISTORY

33A. The Rise of Scientific Medicine
5 units (Lenoir) not given 2000-01

133. The Darwinian Revolution
4 units (Lenoir) not given 2000-01

262S. Undergraduate Research Seminar: Science and High-Technology in the Silicon Valley, 1930-1980
5 units, Aut (Lenoir)

274A. Undergraduate Colloquium: Body Works—Medicine, Technology, and the Body in Late 20th-Century America
4-5 units, Win (Bender, Lenoir, Taylor)

MATERIALS SCIENCE AND ENGINEERING

159Q. Stanford Introductory Seminar: Research in Japanese Companies
3 units, Spr (Sinclair)

POLITICAL SCIENCE

125. The Rise of Industrial Asia
5 units, Aut (Oi, Okimoto, Oksenberg, Rohlen, Rowen)

OVERSEAS STUDIES

These courses are approved for the Science, Technology, and Society major and taught overseas at the campus indicated. Students should discuss with their major advisers which courses would best meet individual needs. Descriptions are in the "Overseas Studies" section of this bulletin or at the Overseas Studies office, 126 Sweet Hall.

BERLIN

117V. The Industrial Revolution and Its Impact on Art, Architecture, and Theory
5 units, Aut (Neckenig)

119V. Architecture and the City, 1871-1990: Berlin as a Nucleus of Modernity—(Same as Overseas Studies 143U.)
4 units, Spr (Neckenig)

120V. Industry, Technology, and Culture, 1780-1945
4 units, Win (Neckenig)

FLORENCE

125V. The Scientific Revolution: From the Renaissance to the 18th Century—(Same as Overseas Studies 215V.)
4-5 units, Win (La Vergata)

214V. Science, Technology, and Art: The Worlds of Leonardo
5 units, Aut (Findlen)